

REMARKS

Claims 1-54, 56, 58, 60-68, 71, 73-79 have been cancelled. Claims 80-83 are withdrawn from consideration. Claims 55 and 69 have been amended. New claims 90-121 have been added. Accordingly, claims 55, 57, 59, 69, 70, 72 and 84-121 are pending in the present application.

In the Office Action dated April 19, 2004, the Examiner rejected claims 55, 57, 59, 69, 70, 72 and 84-89 under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The Examiner also rejected claims 55, 57, 59, 69, 70, 72 and 84-89 under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter. Claims 55, 69, and 84-89 were rejected under 35 U.S.C. 102(b) as being anticipated by Martin et al. (US 5,551,959 A). Finally, claims 57, 59, 70 and 72 were rejected under 35 U.S.C. 103(a) as being unpatentable over Martin et al. (US 5,551,959 A), as applied to claims 55 and 69, respectively, above, in further view of James et al. (US 6,069,080 A).

The rejection of claims 55, 57, 59, 69, 70, 72 and 84-89 under section 112, first paragraph are moot in light of the present amendment, which no longer recites the terms “rigid” and “non-polymeric” with respect to the over layer. Support for the recited materials for the cover layer in amended claims 55 and 69 and new claim 110 may be found in various places in the specification, for example, at page 7, lines 1-2 and at page 10 line 30. Support for the intermediate layer recited in new claim 110 and the materials comprising the same in the dependent claims may be found in the specification at page 11, lines 10-27.

The removal of these elements from the claims is done because the elements are unnecessary to distinguish over the prior art in light of the recitation of the materials comprising the cover layer in the amended base claims. This removal is not an admission that the former recitation of these elements in the claims was not supported in the specification. Applicants submit that the originally recited terms are expressly used, or inherent to the materials described in the specification. The terms “rigid” with respect to the cover layer may be found in the specification, for example at page 9, line 13. The hard and rigid nature of the cover materials is inherent to the exemplary types of materials mentioned in the specification, which are now recited in the claims. The advantages of the hard (and rigid) cover layer are described with

reference to ordinary abrasives set in binders typically used on polishing pads of the prior art as mentioned on page 13, lines 14-19, which compares the claimed polishing pad to the prior art pads using binders.

The amendment also makes the rejection of the claims under section 112, second paragraph, moot because the term rigid has been removed. Again, the removal of this element of the claims is because it is not necessary, not because the former claims were indefinite. Applicants respectfully submit that the term “rigid” is not a term of degree as asserted by the examiner. Rather, the term rigid is a descriptive term commonly understood to mean non-elastic, which is an inherent feature of the hard materials used for the cover layer recited in the claims.

The disclosed embodiments of the invention will now be discussed in comparison to the prior art. Of course, the discussion of the disclosed embodiments, and the discussion of the differences between the disclosed embodiments and the prior art subject matter, do not define the scope or interpretation of any of the claims. Instead, such discussed differences are offered merely help the Examiner appreciate important claim distinctions as they are discussed thereafter.

Applicants invention v. the cited art

The various embodiments of the present invention are directed to polishing pads, apparatuses and methods for making polishing pads used in the manufacture of microelectronic devices. In an embodiment of the invention, a polishing pad has a backing member including a first surface and an opposing second surface. A plurality of pattern elements are distributed on the first surface of the backing member, and a hard cover layer is then applied over the pattern elements, and at least over a portion of the backing member. The pattern elements thus define a plurality of contour surfaces that project away from the first surface of the backing member. The cover layer at least substantially conforms to the contour surfaces of the pattern elements to form a plurality of hard nodules on the backing surface. The hard nodules further define abrasive elements to contact and abrade material from a microelectronic device substrate assembly. Accordingly, the cover layer defines at least a portion of a planarizing surface of the polishing pad. *The cover layer may be comprised of various hard, rigid materials, such as silica nitride, ceria, silica, alumina, titanium nitride, titania, zirconia or other suitable metallic or ceramic materials.*

In a pertinent embodiment of the present invention, a polishing pad is manufactured by non-adhesively depositing a plurality of pattern elements over the first surface of the backing member and then depositing the hard inorganic cover layer over the pattern elements to retain the pattern elements on the backing layer. As discussed in detail in the specification, this approach avoids many of the difficulties encountered in the use of resinous, polymeric binding materials commonly used in prior art polishing pads. For example, as discussed at page 13, lines 10-15, "...the use of a resin binder that holds the abrasive particles may deteriorate or otherwise wear down as the front face of the substrate assembly grinds against the abrasive surface...[so that] the cover layer is expected to be less susceptible to mechanical and chemical wear than the resin binder in existing pads..." (page 13, lines 10-18).

The pattern elements may be deposited onto the first surface of the backing member by drawing or pulling the backing member through a bath having a liquid and having a plurality of the pattern elements suspended in the liquid, and then evaporating the fluid from the pattern elements and the backing member, leaving a plurality of pattern elements non-adhesively distributed on the first surface of the backing member. The hard cover layer may then be deposited over the pattern elements using a chemical vapor deposition process, plasma vapor deposition, or other similar processes to retain the pattern elements on the backing member.

The Examiner cites the Martin reference. Martin discloses an abrasive article having a sheet-like substrate that supports a plurality of abrasive particles and a hard carbon coating layer. With reference to Figure 1 of Martin, a substrate 12 supports abrasive particles 15 that are retained on the substrate 12 by a make coat 14. The abrasive particles are deposited onto and into the make coat..." (col. 7, lines 6-7) "...in partially embedded form to form an abrasive coating." (col. 7 lines 18-20). The make coat consists of a material that is "...based preferably upon organic, thermosetting polymers, although thermoplastic polymers also can be used." (col. 7, lines 63-67). The Applicants thus understand the make coat to *adhesively* bind the abrasive particles to the underlying substrate prior to the application of a hard carbon coating layer 16 that is applied onto the abrasive particles 15 and the make coat 14. In contrast, the various embodiments of Applicants' invention deposit the pattern elements directly onto the substrate without embedding the particles into a resinous and polymeric make coat material. Thus, the hard cover layer generally covers the pattern elements, and contacts at least a portion of the substrate material.

The Examiner asserts that the abrasive particles 15 of Figure 1, and Figure 4 bound in the make coat or binder anticipates the disclosed invention because the make coat or binder may be a polymeric material. Whatever the case, the abrasive composites 15 and 35, shown in Figures 1 and Figure 4 respectively, are not positioned directly on a polymeric *backing material*, which is the equivalent of layers 12, 22, 32 and 42 in Figures 1-4 of Martin, respectively. Instead, in all the embodiments disclosed by Martin, the abrasive particles are embedded in a make coat material 14, 24 or binder layer 36, or binder 44. In all embodiments, the abrasive composites 46 are thus adhesively bonded to the backing materials 12, 22, 32 and 42 and not deposited directly thereon. Applicants point to U.S. Patent No. 5,435,816 to Spurgeon et al. ("Spurgeon") which is incorporated by reference in Martin for this teaching. Specifically, Spurgeon states that the mixture used to form abrasive composites (e.g. the abrasive composites 46 in Figure 4 of Martin) comprises a plurality of abrasive particles dispersed in a binder precursor. The binder precursor may include acrylated urethanes, acrylated epoxies as well as other similar materials which are capable of being cured by exposure to radiant energy. The Examiner is directed specifically to columns 4 through 5 of the Spurgeon reference for this teaching.

The Martin reference therefore does not disclose or even fairly suggest depositing the pattern elements directly onto the substrate surface of the backing material as in Applicants' embodiments.

Moreover, and equally important, the only layer covering the abrasive elements described by Martin is a layer of diamond like cover films (DLC) which are amorphous carbon films, see Martin, Col 1 line 37 for example. Martin provides no teaching and no suggestion to make any polishing pad or lapping device having anything other than a DLC layer covering the abrasive particles. A DLC layer, made of carbon, is nothing like a layer made of: silica nitride, ceria, silica, alumina, titanic nitride, titania, titanium, zirconia, a nitride, a metal or a ceramic as described by Applicants.

The Examiner has further cited the James reference. James discloses a method for manufacturing a fixed abrasive polishing pad by dispersing solid abrasive particles in an aqueous solution of a resin binder and spraying the solution onto a supporting substrate. The resin binder may then be polymerized by exposure to thermal or electromagnetic energy (col. 12, lines 25-35). Accordingly, Applicants respectfully assert that James also teaches adhesively bonding

the abrasive particles to a supporting substrate, even though the application process may include spraying the particles and resin binder onto the supporting substrate.

Turning now to the claims, patentably-distinct differences between the claims and the applied references will be specifically pointed out. Claim 55, as amended, recites in pertinent part, “A method of manufacturing a polishing pad for planarization of a microelectronic-device substrate assembly, comprising...*covering the contour surfaces with a cover layer of a hard, rigid non-polymeric material that contacts portions of the first surface of the backing member and conforms to the contour surfaces to form nodules from the portions of the hard cover layer ...*” (Emphasis added). The Martin reference does not disclose this. Instead, Martin discloses a diamond like carbon layer that does not contact the substrate while also covering the abrasive or pattern elements. Claim 55 is therefore allowable over the cited art. Claims depending from claim 55 are also allowable based upon the allowable form of the base claim and further in view of the additional limitations recited therein.

Claim 69, as amended, recites in pertinent part: “A method of manufacturing a polishing pad for planarization of a microelectronic-device substrate assembly, comprising...*forming a layer of a hard and rigid non-polymeric material on the pattern elements to conform to the contour surfaces, the layer of hard, rigid non-polymeric material also contacting at least a portion of the polymeric backing member...*” (Emphasis added). Again, Martin does not disclose this. Claim 69 is therefore allowable over the cited art. Claims depending from claim 69 are also allowable based upon the allowable form of the base claim and further in view of the additional limitations recited therein.

With regard to the Examiner’s rejections under 35 U.S.C, § 103(a), Applicants respectfully assert that the foregoing amendments also address this basis for rejection, since the rejection is based on the Martin reference in combination with other references.

All of the claims remaining in the application are now clearly allowable.
Favorable consideration and a Notice of Allowance are earnestly solicited.

Respectfully submitted,
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Enclosures:

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